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EXAMINER

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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/665,882
Filing Date: September 19, 2003
Appellant(s): RINERSON ET AL.

MAILED
JUL 05 2007
GROUP 2800

Trueman H. Denny III
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed February 20th, 2007 appealing from the Office action mailed August 2nd, 2006.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is incorrect. The Examiner is now objecting to claims 11 and 19-21. A correct statement of the status of the claims is as follows:

This appeal involves claims 1-5, 8-10, 12-14 and 22-31.

Claims 11 and 19-21 are newly objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

U.S. Patent No. 6759249 Zhuang et al. 7-2004

Sze, S.M. "Physics of Semiconductor Devices, Wiley, New York, 1981

(Appellant refers to the Sze reference in the Appeal Brief of 2/20/2007, but does not include said reference in a listing of evidence. The Examiner has included it here in order to properly respond to Appellant's arguments related thereto.)

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Objections

Claim 31 is objected to because of the following informalities: There is a grammatical error in the claim. The claim, as understood by the Examiner, states that the treatment (to which the at least one interface is subjected) is directed towards changing properties of the perovskite. The Examiner recommends that the 2nd and 3rd lines of the claim be rewritten as --the treatment, to which the at least one interface is subjected, is directed towards changing properties of the perovskite--.

Claim Rejections - 35 USC § 102

Claims 1-5, 8-10, 12-14 and 22-31 are rejected under 35 U.S.C. 102(e) as being anticipated by Zhuang et al. (U.S. Patent # 6759249).

Regarding claim 1, Fig. 1 of Zhuang et al. discloses a resistive memory device comprising:

a conductive bottom electrode 14 having a top surface (on which layer 16 is disposed);

a multi-resistive state element 16 having a top surface (on which layer 18 is disposed) and a bottom surface (under which layer 14 is disposed), the bottom surface of the multi-resistive state element arranged on top of and in direct physical contact with the top surface of the conductive bottom electrode (see Fig. 1), the multi-resistive state element 16 having a substantially crystalline layer 16a (Col. 3, Lines 35-38) that has a modifiable resistance (see Figs. 2-4 of Zhuang et al.);

a conductive top electrode 18 having a bottom surface (under which layer 16 is disposed) and arranged on top of and in direct physical contact with the top surface of the multi-resistive state element (see Fig. 1);

a top interface (interface between layers 16b and 18) created by the direct physical contact between the bottom surface of the top electrode 18 and the top surface of the multi-resistive state element 16b (see Fig. 1); and

a bottom interface (interface between layers 14 and 16a) created by the direct physical contact between the top surface of the bottom electrode 14 and the bottom surface of the multi-resistive state element 16a (see Fig. 1), at least one of the top interface or the bottom interface includes at least one treatment (Col. 3, Lines 13-33) changing properties of the at least one interface (Col. 3, Lines 34-36); and

whereby the properties of the at least one interface are changed by the at least one treatment (Col. 3, Lines 34-36).

The claims to the substantially crystalline layer substantially maintaining its substantially crystalline structure while its' resistance is being modified, the resistance of the resistive memory device being changed by applying a first voltage having a first polarity across the conductive electrodes and being reversibly changed by applying a second voltage having a second polarity across the conductive electrodes are purely functional limitations. It is well known that similar structures will, by their nature, exhibit similar characteristics and functions. Thus, as the device of Zhuang et al. meets the structural limitations of this claim, it should also exhibit similar functional characteristics.

The claim to the at least one treatment being **primarily directed** towards changing properties of the at least one interface (specifically the “primarily directed” portion) is a product by process limitation and lends no patentability to the claim so long as the final product of said claim is the same as or obvious over the prior art. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). The particular process of primarily directing the treatment to changing properties of said interface is therefore unpatentable in this device claim given that the final product is anticipated by Zhuang et al.

Regarding claim 2, Zhuang et al. discloses the resistive memory device of claim 1.

The claim to the at least one treatment being an ion implant is a product by process limitation and lends no patentability to the claim so long as the final product of said claim is the same as or obvious over the prior art. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). The particular process of implanting ions to exact a change in the properties of said interface is therefore unpatentable in this device claim given that the final product is anticipated by Zhuang et al.

To explain further, the device of Zhuang et al. could have been formed by a method that included a step of implanting ions into the PCMO layer 16 of Zhuang et al. As disclosed in Col. 2 (Lines 50-63) of Zhuang et al., the PCMO layer is not defined as a particular stoichiometric combination of Pr, Ca, Mn and O, but is instead defined as having a range of values. Therefore, ions of Pr, Ca, Mn or O could have been

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implanted into the PCMO film during the process of making said film, and the process of implanting these ions would have changed the properties of the interface (as required by claim 1), while maintaining the interface of Zhuang et al. as indistinguishable from the interface of the instant claims. Therefore, it is appropriate to treat the limitation of claim 2 (that the at least one treatment is an ion implant) as a product-by-process limitation because the implied structure of the final product of the instant claim (an ion-implanted multi-resistive state element) is identical to that disclosed by Zhuang et al. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

Regarding claim 3, Zhuang et al. discloses the resistive memory device of claim 1, wherein:

the at least one treatment is an exposure to an anneal (Col. 3, Lines 13-33).

Regarding claim 4, Zhuang et al. discloses the resistive memory device of claim 3, wherein:

the anneal is performed while the multi-resistive state element is formed (Col. 3, Lines 13-33).

Regarding claim 5, Zhuang et al. discloses the resistive memory device of claim 1, wherein:

the at least one treatment is an exposure to a gas (oxygen) (Col. 3, Lines 13-33).

Regarding claim 8, Zhuang et al. discloses the resistive memory device of claim 3, wherein:

the anneal is performed after the conductive bottom electrode is formed (Claim 18) (Col. 7, Lines 45-51).

Regarding claim 9, Zhuang et al. discloses the resistive memory device of claim 3, wherein:

the anneal is performed after the multi-resistive state element is formed (Claim 18) (Col. 7, Lines 45-51).

Regarding claim 10, Zhuang et al. discloses the resistive memory device of claim 3.

The claim to the anneal being performed after the conductive top electrode is formed is a product by process limitation and lends no patentability to the claim so long as the final product of said claim is the same as or obvious over the prior art. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). The particular process of performing the anneal after the top electrode is formed is therefore unpatentable in this device claim given that the final product is anticipated by Zhuang et al. (The anneal in an oxygen atmosphere (as disclosed in Col. 3, Lines 30-33 of Zhuang et al.) will change the properties of the interface regardless of whether the electrode is formed at the time of the anneal or not, as the properties of the underlying layer that forms one side of the interface are changed by the anneal).

Regarding claim 12, Zhuang et al. discloses the resistive memory device of claim 5, wherein:

the exposure to the gas is performed after the conductive bottom electrode is formed (Claim 18) (Col. 7, Lines 45-51).

Regarding claim 13, Zhuang et al. discloses the resistive memory device of claim 5, wherein:

the exposure to the gas is performed after the multi-resistive state element is formed (Claim 18) (Col. 7, Lines 45-51).

Regarding claim 14, Zhuang et al. discloses the resistive memory device of claim 5.

The claim to the gas exposure step being performed after the conductive top electrode is formed is a product by process limitation and lends no patentability to the claim so long as the final product of said claim is the same as or obvious over the prior art. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). The particular process of performing the gas exposure after the top electrode is formed is therefore unpatentable in this device claim given that the final product is anticipated by Zhuang et al. (The anneal in an oxygen atmosphere (as disclosed in Col. 3, Lines 30-33 of Zhuang et al.) will change the properties of the interface regardless of whether the electrode is formed at the time of the anneal or not, as the properties of the underlying layer that forms one side of the interface are changed by the oxygen anneal).

Regarding claims 22 and 23, Zhuang et al. discloses the resistive memory device of claim 1.

The claims to the at least one treatment being caused by a plasma process/plasma etch are product by process limitations and are given no patentable weight so long as the final product of said claims are the same as or obvious over the prior art. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). The particular process of causing the treatment by a plasma process or a plasma etch is therefore irrelevant given that the final product is anticipated by Zhuang et al. The device of Zhuang et al. does not specifically teach a plasma process or a plasma etching step. However, the patterned top electrode layer (formed by depositing platinum through a mask) could have been formed by a process where a full platinum layer was deposited and then selectively etched, using a plasma etching process, to form a layer identical to the layer formed by Zhuang et al. and seen in Fig. 1 of Zhuang et al. as reference number 18. Further, the removal of selected portions of the top electrode layer would constitute a change in the properties of the interface. Thus, a plasma process could have been performed on the structure disclosed by Zhuang et al., and the final structure of Zhuang et al. is consistent with such a process having been performed.

Regarding claim 24, Zhuang et al. discloses the resistive memory device of claim 1, wherein:

both the bottom interface (interface between layers 14 and 16a) and the top interface (interface between layers 16b and 18) are subject to a treatment, the treatments being different from each other (Col. 3, Lines 13-33). Said bottom interface is subjected to a different treatment than said top interface, as the bottom interface is subjected to a larger number of annealing steps than is the top interface (Col. 3, Lines 13-33).

Regarding claim 25, Zhuang et al. discloses the resistive memory device of claim 1.

The claim to the at least one treatment being caused by re-sputtering is a product by process limitation and is given no patentable weight so long as the final product of said claim is the same as or obvious over the prior art. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). The particular process of causing the treatment by re-sputtering (a process which, according to the Appellant's specification, is commonly used to clean up surfaces, and does not result in a new film being deposited) is therefore irrelevant given that the final product is anticipated by Zhuang et al. While the device of Zhuang et al. does not specifically teach a re-sputtering step, the addition of a re-sputtering step into the process of forming the device of Zhuang et al. would not exact any changes to the device of Zhuang et al. as the re-sputtering would not result in

any films being deposited and thus the final product of Zhuang et al. is indistinguishable from the structure implied by the instant claim.

Regarding claim 26, Zhuang et al. discloses the resistive memory device of claim 1.

The claim to the at least one treatment being caused by a bombardment by inert ions is a product by process limitation and is given no patentable weight so long as the final product of said claim is the same as or obvious over the prior art. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). The particular process of causing the treatment by bombardment by inert ions is therefore irrelevant given that the final product is anticipated by Zhuang et al. While the device of Zhuang et al. does not specifically teach a bombardment with inert ions, the addition of a step where inert ions are bombarded prior to the annealing step would not result in any changes to the device of Zhuang et al. as the inert ions would dissipate from the final structure during the annealing step. Thus, the final product of Zhuang et al. is indistinguishable from the structure implied by the instant claim.

Regarding claim 27, Zhuang et al. discloses the resistive memory device of claim 1.

The claim to the at least one treatment being caused by a laser treatment (such as a laser thermal anneal) is a product by process limitation and is given no patentable weight so long as the final product of said claim is the same as or obvious over the prior

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art. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). The particular process of causing the treatment by a laser treatment (such as a laser thermal anneal) is therefore irrelevant given that the final product is anticipated by Zhuang et al. (Zhuang et al. teaches that the treatment can be an annealing step.)

Regarding claim 28, Zhuang et al. discloses a resistive memory device comprising:

- a conductive bottom electrode 14 having a top surface (on which layer 16 is disposed);

- a multi-resistive state element 16 having a top surface (on which layer 18 is disposed) and a bottom surface (under which layer 14 is disposed), the bottom surface of the multi-resistive state element arranged on top of and in direct physical contact with the top surface of the conductive bottom electrode (see Fig. 1), the multi-resistive state element 16 having at least one layer 16a that is fabricated to be substantially crystalline (Col. 3, Lines 35-38) and have a programmable resistance (see Figs. 2-4 of Zhuang et al.);

- a conductive top electrode 18 having a bottom surface (under which layer 16b is disposed) and arranged on top of and in direct physical contact with the top surface of the multi-resistive state element 16b(see Fig. 1);

- a top interface (interface between layers 16b and 18) created by the direct physical contact between the bottom surface of the top electrode 18 and the top surface of the multi-resistive state element 16b (see Fig. 1); and

a bottom interface (interface between layers 14 and 16a) created by the direct physical contact between the top surface of the bottom electrode 14 and the bottom surface of the multi-resistive state element 16a (see Fig. 1), at least one of the top interface or the bottom interface includes a treatment (Col. 3, Lines 13-33) changing properties of the at least one interface (Col. 3, Lines 34-36)

whereby the properties of the at least one interface are changed by the at least one treatment (Col. 3, Lines 34-36).

The claim to the resistance of the resistive memory device being programmed by applying a first voltage having a first polarity across the conductive electrodes and being reversibly programmed by applying a second voltage having a second polarity across the conductive electrodes is a purely functional limitation. It is well known that similar structures will, by their nature, have similar characteristics and functions. Thus, as the device of Zhuang et al. meets the structural limitations of this claim, it should also exhibit similar functional characteristics.

The claim to the at least one treatment being **primarily directed** towards changing properties of the at least one interface (specifically the "primarily directed" portion) is a product by process limitation and lends no patentability to the claim so long as the final product of said claim is the same as or obvious over the prior art. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). The particular process of primarily directing the treatment to changing properties of said interface is therefore unpatentable in this device claim given that the final product is anticipated by Zhuang et al.

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Regarding claim 29, Zhuang et al. discloses the resistive memory device of claim 28, wherein:

the at least one layer 16a that is fabricated to be substantially crystalline (Col. 3, Lines 35-38) is fabricated to be polycrystalline (Col. 3, Lines 35-38).

Regarding claim 30, Zhuang et al. discloses the resistive memory device of claim 28, wherein:

the at least one layer that is fabricated to be substantially crystalline 16a is fabricated to be a perovskite (PCMO) (Col. 1, Lines 15-20) (Col. 3, Lines 13-33).

Regarding claim 31, Zhuang et al. discloses the resistive memory device of claim 30, wherein:

the treatment (the anneal in an oxygen gas found in Col. 3, Lines 30-33 of Zhuang et al.), to which the at least one interface is subjected, is directed towards changing properties of the perovskite (PCMO)(Col. 3, Lines 34-36).

Allowable Subject Matter

Claims 11, 19-21 and 26 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

Regarding claims 11 and 19-21, the closest prior art (Zhuang et al., Buckley and Liu et al. (all of record)) fails to disclose (by themselves or in combination) there having been a chemical reaction in the multi-resistive state material (claim 11) or between one of the conductive electrodes and the multi-resistive state element (claim 19) in combination with the additionally claimed features, as are claimed by the Appellant. Such a chemical reaction would result in there being products of said reaction remaining in the structure, which is neither taught nor suggested by the above-cited closest prior art. Thus, the Appellant's claims are determined to be novel and non-obvious.

Regarding claim 26, the closest prior art (Zhuang et al., Buckley and Liu et al. (all of record)) fails to disclose (by themselves or in combination) the at least one treatment being caused by a bombardment by inert ions in combination with the additionally claimed features, as are claimed by the Appellant. The bombardment of inert ions would result in inert ions remaining in the structure, which is neither taught nor suggested by the above-cited closest prior art. Thus, the Appellant's claims are determined to be novel and non-obvious.

(10) Response to Arguments

Independent Claim 1

Regarding claim 1, Appellant argues regarding the interfaces in the instant claim that “the definition set forth in Sze (that a transition or interfacial layer will be formed at the claimed interface)...aptly describes the top and bottom interfaces recited in independent Claims 1 and 28...”. The Examiner disagrees with this assertion. The instant claims state that the “top interface (is) created by the **direct physical contact** between the bottom surface of the top electrode and the top surface of the multi-resistive state element” (Instant claim 1, Lines 14 and 15)(emphasis added). Thus, the instant claims limit the structure by clearly stating that there is a direct physical contact between the two respective layers, therefore eliminating the possibility of the existence of an interfacial layer, as is suggested in the Appellant’s argument. Further, the Examiner notes that Merriam-Webster’s Online Dictionary defines the term interface to mean “a **surface** forming a common boundary of two bodies”

Appellant further argues that the PCMO layer 16 of Zhuang et al. is not substantially a crystalline layer, as layer 16b is defined as amorphous and “the bottom layer 16a may include nano-meter sized crystals, but that does not result in the entire PCMO layer 16 being a substantially crystalline layer”. The Examiner does not disagree with these arguments, but points out that the instant claim language does not require that the entire multi-resistive state element (analogous to layer 16 (both 16a and 16b) of Fig. 1 of Zhuang et al.) be substantially crystalline. Claim 1 states “the multi-resistive state element **having a substantially crystalline layer...**”. Thus, the limitation in

question merely requires that the multi-resistive state element contain **a layer** that is substantially crystalline, and does not require the entirety of the multi-resistive state element to be substantially crystalline as is suggested by Appellant's argument.

Therefore, the layer 16a (Zhuang et al., Fig. 1), described as having "nano-meter size crystals" (Zhuang et al., Col. 3, Lines 35-37) satisfies the requirement that a layer (Zhuang et al., Fig. 1 (16a)) of the multi-resistive state element (Zhuang et al., Fig. 1 (16)) be substantially crystalline.

Finally, regarding claim 1, Appellant argues re the limitation of "at least one of the top interface or the bottom interface includes at least one treatment primarily directed towards changing properties of the at least one interface, and whereby the properties of the at least one interface are changed by the at least one treatment". Specifically, Appellant argues that Zhuang et al. does not disclose a treatment which is **primarily directed** towards changing a property of one of said interfaces, and further argues that if the limitation in question is to have "any meaning whatsoever, those words must exclude treatments that effect entire bulk films". The Examiner argues that the limitation "at least one treatment primarily directed towards changing properties of the at least one interface" can be treated as a product by process limitation and is thus only given patentable weight to the degree in which the limitation implies structural differences in the final product (M.P.E.P. §2113). Thus, the above limitation is only given patentable weight to the extent that the properties of said interface in said final product must be shown to either have been changed in some way, or be consistent with (i.e., exhibit the properties of) an interface that has had its' properties changed in some way, by a type

of treatment. The limitation "primarily directed" is given no patentable weight in the current claim, as the artisan's intended target of said treatment is irrelevant to the structure of the final product, so long as the claimed intended target (interface) is affected (i.e., properties of the target are changed), or exhibits properties consistent with a target that has been affected, by a treatment. For example, an annealing treatment, such as that described by Zhuang et al. (Col. 3, Lines 30-33) satisfies the requirements of this claim as it teaches that the properties of the interface (the surface forming the boundary between the two layers) are changed ("the PCMO film is no longer in a single crystal form" (Col. 3, Lines 34-35)), but that the PCMO film still contains a substantially crystalline layer 16a (Col. 3, Lines 35-37).

Dependent Claim 2

Regarding claim 2, Appellant argues that the process of ion implanting "results in a change in the structure of the interface that (is) distinct from the structure of the material in the layers that adjoin the interface, that is, species of the implanted ion would primarily reside in (the) region that defines the interface." The Examiner argues that the device of Zhuang et al. could have been formed by a method that included a step of implanting or depositing ions into the PCMO layer 16 of Zhuang et al. As disclosed in Col. 2 (Lines 50-63) of Zhuang et al., the PCMO layer is not defined as a particular stoichiometric combination, but is instead defined as having a range of values. Therefore, if ions of Pr, Ca, Mn or O had been implanted or deposited into the PCMO film during the process of making said film, said process of implanting or depositing

these ions would have changed the properties of the interface (as required by claim 1), while maintaining the interface of Zhuang et al. as indistinguishable from the interface of the instant claims. Therefore, it is appropriate to treat the limitation of claim 2 (that the at least one treatment is an ion implant) as a product-by-process limitation because the final product of said claim (an ion-implanted multi-resistive state element) is identical to that disclosed by Zhuang et al. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

Dependent Claims 3-4 and 8-10

Regarding claims 3-4 and 8-10, Appellant argues that Zhuang et al. does not disclose an anneal which is ***primarily directed*** towards changing a property of one of said interfaces, and further argues that if the limitation in question is to have “any meaning whatsoever, those words must exclude treatments that effect entire bulk films”. The Examiner argues that the limitation “at least one treatment primarily directed towards changing properties of the at least one interface” can be treated as a product by process limitation and is thus only given patentable weight to the degree in which the limitation implies structural differences in the final product (M.P.E.P. §2113). Thus, the above limitation is only given patentable weight to the extent that the properties of said interface in said final product must be shown to either have been changed in some way, or be consistent with (i.e., exhibit the properties of) an interface that has had its’ properties changed in some way, by an anneal. The limitation “primarily directed” is given no patentable weight in the current claim, as the artisan’s intended target of said

anneal is irrelevant to the structure of the final product, so long as the claimed intended target (interface) is affected (i.e., properties of the target are changed), or exhibits properties consistent with a target that has been affected, by an anneal. Therefore, the annealing treatment described by Zhuang et al. (Col. 3, Lines 30-33) satisfies the requirements of this claim as it teaches that the properties of the interface (the surface forming the boundary between the two layers) are changed ("the PCMO film is no longer in a single crystal form" (Col. 3, Lines 34-35)).

Specifically regarding claim 10, while the anneal is performed before the conductive top electrode (Zhuang et al., Fig. 1 (18)) is formed, the anneal will still modify the properties of the interface, as it (the anneal) causes changes in the state/phase of the material that forms layer 16b (the amorphous layer).

Dependent Claims 5 and 11-14

Regarding claim 5 (and 11-14 (depending therefrom)), Appellant argues that Zhuang et al. fails to explicitly or inherently teach an exposure to a gas changing properties of an interface. As the step of annealing in an oxygen atmosphere changes the properties of the interface, as is argued above regarding claim 3, the Examiner argues that the anneal step performed in an oxygen atmosphere (Zhuang et al., Col. 3, Lines 30-33) satisfies the requirements of this claim.

Regarding claim 11, the previous rejection (as being anticipated by Zhuang et al.) is withdrawn and the claim is currently objected as being dependent from a rejected claim (claims 1 and 5).

Specifically regarding claim 14, while the anneal in an oxygen atmosphere is performed before the conductive top electrode (Zhuang et al., Fig. 1 (18)) is formed, said anneal will still modify the properties of the interface, as it (the anneal) changes the state/phase of the material that forms layer 16b (the amorphous layer).

Dependent Claims 19-21

Regarding claims 19-21, the previous rejection (as being anticipated by Zhuang et al.) is withdrawn and the claim is currently objected as being dependent from a rejected claim (claim 1).

Dependent Claims 22 and 23

Regarding claims 22 and 23, the Examiner argues that the claims to the at least one treatment being caused by a plasma process/plasma etch are product by process limitations and are given no patentable weight so long as the final product of said claims are the same as or obvious over the prior art. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). The particular process of causing the treatment by a plasma process or a plasma etch is therefore irrelevant given that the final product is anticipated by Zhuang et al. While the device of Zhuang et al. does not specifically teach a plasma process or a plasma etching step, the patterned top electrode layer 18 of Zhuang et al. (formed by depositing platinum through a mask) could have been formed by a process where a full platinum layer was deposited and then selectively etched, using a plasma etching process, to form a layer identical to the layer formed by

Zhuang et al. and seen in Fig. 1 of Zhuang et al. as reference number 18. Further, the removal of selected portions of the top electrode layer would constitute a change in the properties of the interface. Thus, a plasma process could have been performed on the structure (including a side of the interface) disclosed by Zhuang et al., and the final product of Zhuang et al. is consistent with such a process having been performed.

Dependent Claim 24

Regarding claim 24, Appellant argues that Zhuang et al. does not disclose the treatments of the top interface and the bottom interface being different from one another. The Examiner argues that it is clear in Zhuang et al. (Col. 3, Lines 13-33) that the bottom interface is subjected to a different treatment than the top interface, as the bottom interface is subjected to a larger number of annealing steps than is the top interface.

Dependent Claim 25

Regarding claim 25, the Examiner argues that the claim to the at least one treatment being caused by re-sputtering is a product by process limitation and is given no patentable weight so long as the final product of said claim is the same as or obvious over the prior art. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). The particular process of causing the treatment by a re-sputtering (a process which, according to the Appellant's specification, is commonly used to clean up surfaces, and does not result in a new film being deposited) is therefore irrelevant given

that the final product is anticipated by Zhuang et al. While the device of Zhuang et al. does not specifically teach a re-sputtering step, the addition of a re-sputtering step into the process of forming the device of Zhuang et al. would not exact any changes to the device of Zhuang et al. as the re-sputtering would not result in any films being deposited, and thus the final product of Zhuang et al. is indistinguishable from the structure implied by the instant claim.

Dependent Claims 26 and 27

Regarding claim 26, the claim to the at least one treatment being caused by a bombardment by inert ions is a product by process limitation and is given no patentable weight so long as the final product of said claim is the same as or obvious over the prior art. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). The particular process of causing the treatment by bombardment by inert ions is therefore irrelevant given that the final product is anticipated by Zhuang et al. While the device of Zhuang et al. does not specifically teach a bombardment with inert ions, the addition of a step where inert ions are bombarded prior to the annealing step would not result in any changes to the device of Zhuang et al. as the inert ions would dissipate from the final structure during the annealing step. Thus, the final product of Zhuang et al. is indistinguishable from the structure implied by the instant claim.

Regarding claim 27, the Examiner argues that as the Zhuang et al. reference teaches an annealing step as the treatment, and a laser treatment known in the art is a laser thermal anneal, the structure of the instant claim (i.e., an interface that has been

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treated using a laser thermal anneal) is anticipated by effects of the annealing treatment disclosed by Zhuang et al.

Independent Claim 28

Appellant's arguments regarding claims 28, 30 and 31 are the same as those regarding claim 1, which are addressed above.

Dependent Claim 29

Appellant argues, regarding claim 29, that "one of ordinary skill in the art is not put on notice that the entire PCMO layer 16 is polycrystalline...". Again, the Examiner agrees with this assessment, but argues that the claim only requires that "a layer" of the multi-resistive state element (analogous to layers 16a and 16b of Fig. 1 of Zhuang et al.) be crystalline/polycrystalline. Therefore, as is argued above in reference to claim 1, the layer 16a (Zhuang et al., Fig. 1), described as having "nano-meter size crystals" (Zhuang et al., Col. 3, Lines 35-37) satisfies the requirement that a layer (Zhuang et al., Fig. 1 (16a)) of the multi-resistive state element (Zhuang et al., Fig. 1 (16)) be substantially crystalline.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.


Respectfully submitted,

William F. Kraig



Conferees:

Tom Thomas 



David Blum



EUGENE LEE
PRIMARY EXAMINER